

# Catalysts

## Worksheet

Combined Science - Chemistry - Key Stage 4

The Rate and Extent of Chemical Change

Dr Deng



# Periodic Table of Elements

Key:

relative atomic mass → **1**

Name → hydrogen

Atomic symbol → **H**

Atomic (proton number) → 1

1 <b>H</b> hydrogen 1																	4 <b>He</b> helium 2
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4											11 <b>B</b> boron 5	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	20 <b>Ne</b> neon 10
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12											27 <b>Al</b> aluminium 13	28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	40 <b>Ar</b> argon 18
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	59 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[97] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[267] <b>Rf</b> rutherfordium 104	[270] <b>Db</b> dubnium 105	[269] <b>Sg</b> seaborgium 106	[270] <b>Bh</b> bohrium 107	[270] <b>Hs</b> hassium 108	[278] <b>Mt</b> meitnerium 109	[281] <b>Ds</b> darmstadtium 110	[281] <b>Rg</b> roentgenium 111	[285] <b>Cn</b> copernicium 112	[286] <b>Nh</b> nihonium 113	[289] <b>Fl</b> flerovium 114	[289] <b>Mc</b> moscovium 115	[293] <b>Lv</b> livermorium 116	[293] <b>Ts</b> tennessine 117	[294] <b>Og</b> oganesson 118

\* The lanthanides (atomic numbers 58 - 71) and the Actinides (atomic numbers 90 - 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.



# Multiple choice quiz



# Which of the following best describes 'activation energy'?

A

Maximum amount of energy required for successful collisions

B

Minimum amount of energy required for successful collisions

C

Maximum amount of energy taken in from the surrounding

D

Minimum amount of energy taken in from the surrounding



**Which of the following best describes 'activation energy'?**

**B**

Minimum amount of energy required for successful collisions



# Where can nickel be found on the periodic table?

A

Group 1

B

Group 3

C

Group 7

D

Transition metals



# Where can nickel be found on the periodic table?

D

Transition metals



# Which of the following is NOT a feature of catalysts?

A

Speeds up reactions

B

Provides alternative pathway for reaction to take place

C

Increases activation energy

D

Does not get used up





Which of the following is NOT a feature of catalysts?

C

Increases activation energy



# What does an endothermic reaction mean?

A

A reaction where energy is taken in from the surrounding

B

A reaction where energy is given out to the surrounding

C

A reaction where activation energy is needed to start

D

A reaction where catalysts are needed



# What does an endothermic reaction mean?

A

A reaction where energy is taken in from the surrounding



# What does an exothermic reaction mean?

A

A reaction where energy is taken in from the surrounding

B

A reaction where energy is given out to the surrounding

C

A reaction where activation energy is needed to start

D

A reaction where catalysts are needed



# What does an exothermic reaction mean?

**B**

A reaction where energy is given out to the surrounding



# Exam style question 1

A student investigated the effect of using different catalysts on the decomposition of hydrogen peroxide:



The following observations were made by the student:

Catalyst	Observation
copper (II) oxide	few gas bubbles
catalase	steady release of gas bubbles
manganese dioxide	lots of bubbles, hydrogen peroxide bubbles out of the boiling tube

Explain which catalyst is the most useful. (2 marks)

---

---



## Exam style question 2

Explain how catalysts speed up rate of reaction. (3 marks)

---

---

---

---

---

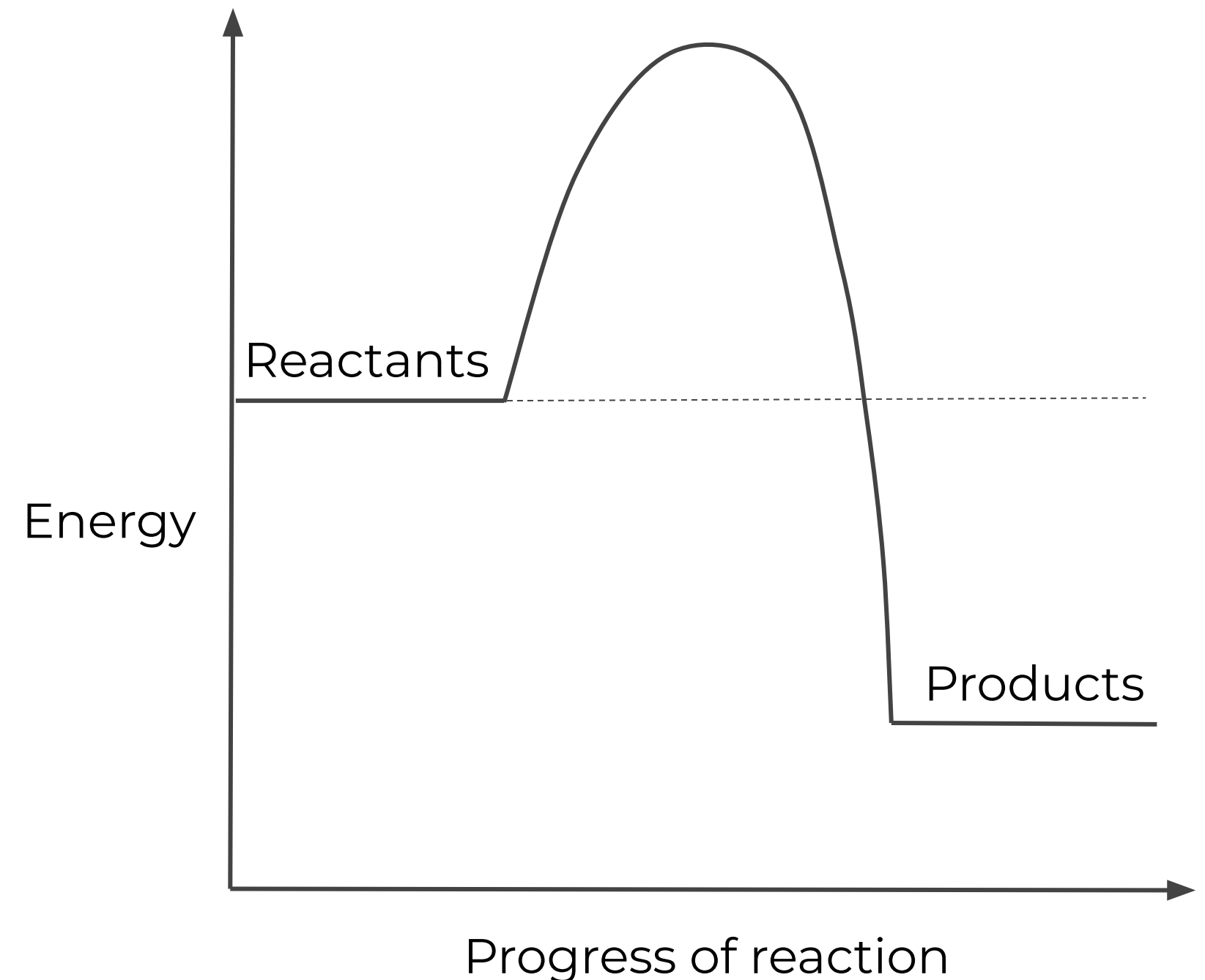


## Exam style question 3

The figure shows a reaction profile for an uncatalysed reaction.

(4 marks)

- Is the reaction endothermic or exothermic? How do you know? (2)
- Label the activation energy. (1)
- Draw the reaction profile for the reaction with a catalyst. (1)



Reaction profile, E Deng





# Exam style question 1 answer

A student investigated the effect of using different catalysts on the decomposition of hydrogen peroxide:



The following observations were made by the student:

Catalyst	Observation
copper (II) oxide	few gas bubbles
catalase	steady release of gas bubbles
manganese dioxide	lots of bubbles, hydrogen peroxide bubbles out of the boiling tube

Explain which catalyst is the most useful. (2 marks)

Catalase, it is effective but also safe and manageable

---

---



## Exam style question 2 answer

Explain how catalysts speed up rate of reaction. (3 marks)

by lowering the activation energy - 1

---

providing an alternative pathway for the reaction - 1

---

without being used up - 1

---

---

---



# Exam style question 3 answer

The figure shows a reaction profile for an uncatalysed reaction.

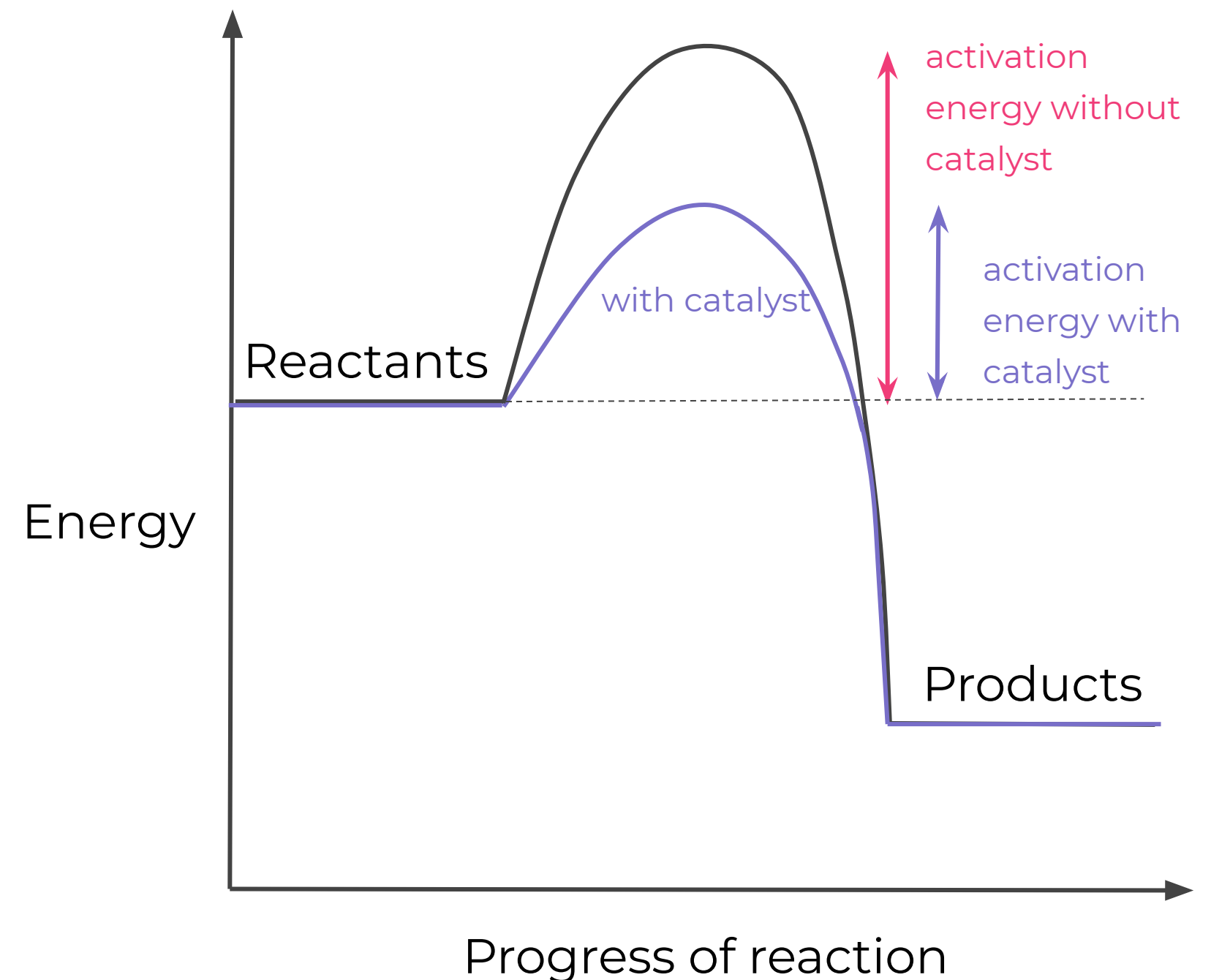
(4 marks)

- a) Is the reaction endothermic or exothermic? How do you know?

Exothermic, energy of products is lower than energy of reactants.

- b) Label the activation energy.

- c) Draw the reaction profile for the reaction with a catalyst.



Reaction profile, E Deng

